Shaping the Page

An
excerpt
from
The Elements of Typographic Style
by Robert Binghurst

Scribes and typographers, like architects, have been shaping visual spaces for thousands of years. Certain proportions keep recurring in their work because they please the eye and the mind, just as certain sizes keep recurring because they are comfortable to the hand. Many of these proportions are inherent in simple geometric figures - equilateral triangle, square, regular pentagon, hexagon and octagon. And these proportions not only seem to please human beings in many different centuries and countries, they are also prominent in nature far beyond the human realm. They occur in the structures of molecules, mineral crystals, soap bubbles, flowers, as well as books and temples, manuscripts and mosques.

The mathematics are not here to impose drudgery upon anyone. On the contrary, they are here entirely for pleasure. They are here for the pleasure of those who like to examine what they are doing, or what they might do or have already done, perhaps in the hope of doing it still better. Those who prefer to act directly at all times, and to leave the analysis to others, may be content in this chapter to study the picture and skim the text.

The Compositional Collective

SHAPING THE PAGE

8

A book is a flexible mirror of the mind and the body. Its overall size and proportions, the color and texture of the paper, the sound it makes as the pages turn, and the smell of the paper, adhesive and ink, all blend with the size and form and placement of the type to reveal a little about the world in which it was made. If the book appears to be only a paper machine, produced at their own convenience by other machines, only machines will want to read it.

8.1 ORGANIC, MECHANICAL & MUSICAL PROPORTION

A page, like a building or a room, can be of any size and proportion, but some are distinctly more pleasing than others, and some have quite specific connotations. A brochure that unfolds and refolds in the hand is intrinsically different from a formal letter that lies motionless and flat, or a handwritten note that folds into quarters and comes in an envelope of a different shape and size. All of these are different again from a book, in which the pages flow sequentially in pairs.

Much typography is based, for the sake of convenience, on standard industrial paper sizes, from 35 × 45 inch press sheets to 3½ × 2 inch conventional business cards. Some formats, such as the booklets that accompany compact discs, are condemned to especially rigid restrictions of size. But many typographic projects begin with the opportunity and necessity of selecting the dimensions of the page.

There is rarely a free choice. A page size of 12 × 19 inches, for example, is likely to be both inconvenient and expensive because it is just in excess of 11 × 17, which is a standard industrial unit. And a brochure that is 5 × 9 inches, no matter how handsome, might be unacceptable because it is too wide to fit into a standard business envelope (4×9½). But when the realm of practicality has been established, and it is known that the page must fall within certain limits, how is one to choose? By taking whatever is easiest, or biggest, or whatever is the most convenient standard size? By trusting to blind instinct?

Instinct, in matters such as these, is largely memory in disguise. It works quite well when it is trained, and poorly otherwise.

But in a craft like typography, no matter how perfectly honed one's instincts are, it is useful to be able to calculate answers exactly. History, natural science, geometry and mathematics are all relevant to typography in this regard – and can all be counted on for aid.

Organic, Mechanical and Musical Proportion

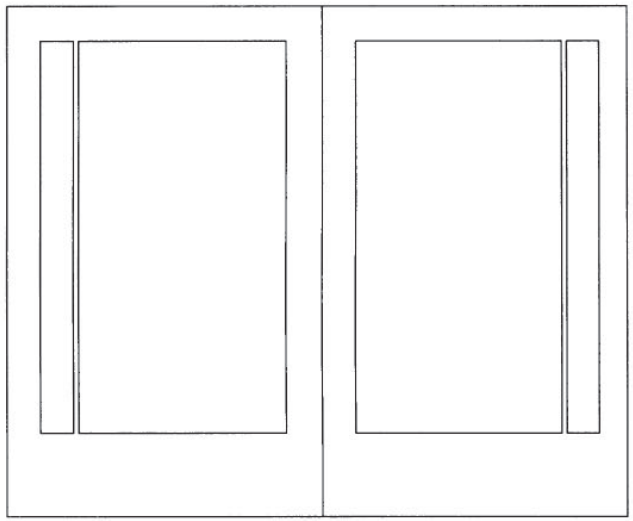
Scribes and typographers, like architects, have been shaping visual spaces for thousands of years. Certain proportions keep recurring in their work because they please the eye and the mind, just as certain sizes keep recurring because they are comfortable to the hand. Many of these proportions are inherent in simple geometric figures – equilateral triangle, square, regular pentagon, hexagon and octagon. And these proportions not only seem to please human beings in many different centuries and countries, they are also prominent in nature far beyond the human realm. They occur in the structures of molecules, mineral crystals, soap bubbles, flowers, as well as books and temples, manuscripts and mosques.

Two very useful works on natural form and structure are D'Arcy Thompson, *On Growth and Form* (rev. ed., 1942) and Peter S. Stevens, *Patterns in Nature* (1974). An equally important book on structures made by humans is Dorothy Washburn & Donald Crowe, *Symmetries of Culture: Theory and Practice of Plane Pattern Analysis* (1988)

The tables on pages 148–149 list a number of page proportions derivable from simple geometric figures. These proportions occur repeatedly in nature, and pages that embody them recur in manuscripts and books from Renaissance Europe, Táng and Sòng dynasty China, early Egypt, precolumbian Mexico and ancient Rome. It seems that the beauty of these proportions is more than a matter of regional taste or immediate fashion. They are therefore useful for two purposes. Working and playing with them is a way of developing good typographic instincts, and they serve as useful references in analyzing old designs and calculating new ones.

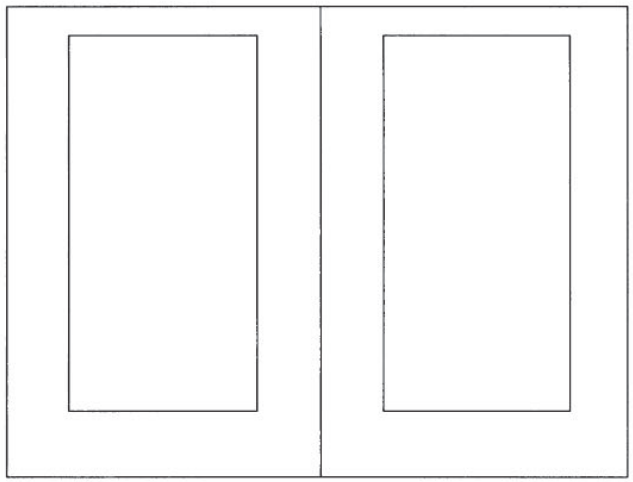
For comparison, several other proportions are included in the tables. There are several simple numerical ratios, several standard industrial sizes, and several proportions involving four irrational numbers important in the analysis of natural structures and processes. These numbers are $\pi = 3.14159\ldots$, which is the circumference of a circle whose diameter is one; $\sqrt{2} = 1.41421\ldots$, which is the diagonal of a unit square; $e = 2.71828\ldots$, which is the base of the natural logarithms; and $\varphi = 1.61803\ldots$, a number discussed in greater detail on page 155. Certain of these proportions reappear in the structure of the human body; others appear in musical scales. Indeed, one of the simplest of all systems of page proportions is based on the familiar intervals of the diatonic scale. Pages that embody these basic musical proportions have been in common use in Europe for more than a thousand years.

Examples



P = 1.62 [golden section]; T = 1.87 [tall hexagon]. Margins: $s = w/9$; $t = s$; $e = 2s$. Secondary column: $g = w/75$; $n = s$. The text is in Claude Garamond's 14 pt roman; the sidenotes are 12 pt italic. The gutter between main text and sidenotes is tiny: 6 or 7 pt against a main text measure of 33.5 picas. But the differences in size and face prevent any confusion. The text is a history of the Hundred Years' War. (Jean Froissart, *Histoire et chronique*, Jean de Tournes, Paris, 1559.) Original size: roughly 21 × 34 cm.

This grid is analyzed on the facing page.



Shaping the Page

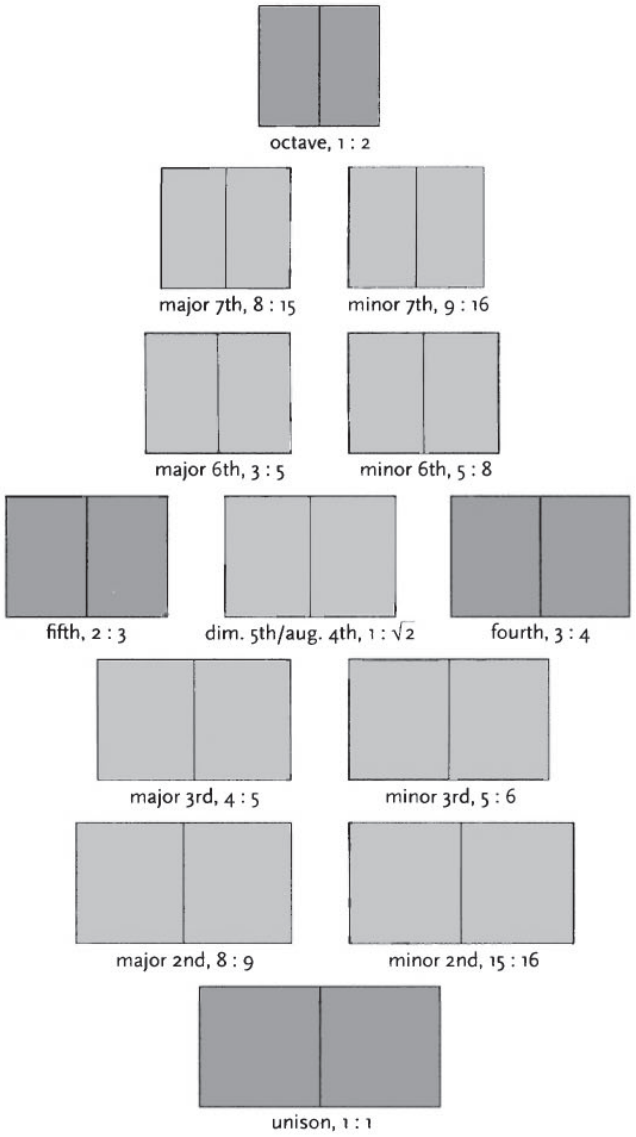
Sizing and spacing type, like composing and performing music or applying paint to canvas, is largely concerned with intervals and differences. As the texture builds, precise relationships and very small discrepancies are easily perceived. Establishing the overall dimensions of the page is more a matter of limits and sums. In this realm, it is usually sufficient, and often it is better, if structural harmony is not so much enforced as implied. That is one of the reasons typographers tend to fall in love with books. The pages flex and turn; their proportions ebb and flow against the underlying form. But the harmony of that underlying form is no less important, and no less easy to perceive, than the harmony of the letterforms themselves.

The page is a piece of paper. It is also a visible and tangible proportion, silently sounding the thoroughbass of the book. On it lies the textblock, which must answer to the page. The two together – page and textblock – produce an antiphonal geometry. That geometry alone can bond the reader to the book. Or conversely, it can put the reader to sleep, or put the reader's nerves on edge, or drive the reader away.

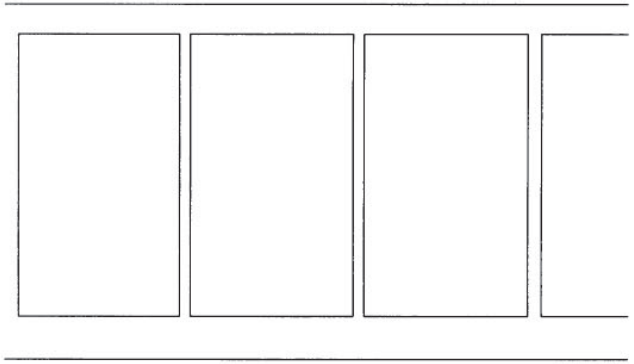
The textblock is known in Chinese as *yèxīn* (頁心), a useful phrase. *Yè* means *page*; *xīn* means *heart* and *mind*.

Arithmetic and mathematics also drive away some readers, and this is a chapter peppered with both. Readers may well ask whether all this is necessary, merely in order to choose where some letters should sit on a piece of paper and where the paper itself should be trimmed. The answer, naturally, is no. It is not in the least necessary to understand the mathematics in order to perform the actions that the math describes. People walk and ride bicycles without mathematical analyses of these complex operations. The chambered nautilus and the snail construct perfect logarithmic spirals without any need of logarithmic tables, sliderules or the theory of infinite series. The typographer likewise can construct beautiful pages without knowing the meaning of symbols like π or φ, and indeed without ever learning to add and subtract, if he has a well-educated eye and knows which buttons to push on the calculator and keyboard.

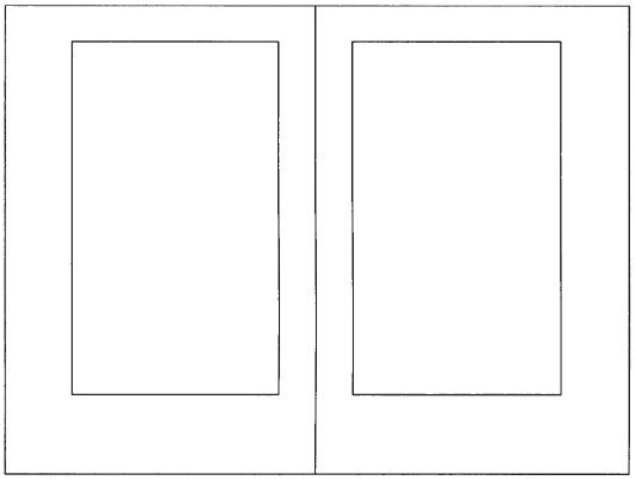
The mathematics are not here to impose drudgery upon anyone. On the contrary, they are here entirely for pleasure. They are here for the pleasure of those who like to examine what they are doing, or what they might do or have already done, perhaps in the hope of doing it still better. Those who prefer to act directly at all times, and to leave the analysis to others, may be content in this chapter to study the pictures and skim the text.


octave, 1 : 2
major 7th, 8 : 15
minor 7th, 9 : 16
major 6th, 3 : 5
minor 6th, 5 : 8
fifth, 2 : 3
dim. 5th/aug. 4th, 1 : √2
fourth, 3 : 4
major 3rd, 4 : 5
minor 3rd, 5 : 6
major 2nd, 8 : 9
minor 2nd, 15 : 16
unison, 1 : 1

Page proportions corresponding to the chromatic scale, from unison (at the bottom) to octave (at the top). The musical correlations are shown in detail on the facing page.



P = variable; T = 1.75. Margins: $t = h/12$; $f = 3t/2$; $g = t/2$ or $t/3$. Text columns from Isaiah Scroll A, from Qumran Cave 1, on the Dead Sea. The column depth is 29 lines and the measure is 28 picas, giving a line length of roughly 40 characters. Elsewhere in the scroll, column widths range from 21.5 to 39 picas. Paragraphs begin on a new line but – in keeping with the crisp, square Hebrew characters – are not indented. (Palestine, perhaps first century BC.) Original size: 26 × 725 cm.



P = 1.5 [2 : 3]; T = 1.7 [tall pentagon]. Margins: $s = t = w/9$; $e = 2s$. The text is a fantasy novel, Francesco Colonna's *Hypnerotomachia Poliphili*, set in a roman font cut by Francesco Griffo. (Aldus Manutius, Venice, 1499.) Original size: 20.5 × 31 cm.

Examples

The formula for designing a perfect page is the same as the formula for writing one: start at the upper left hand corner and work your way across and down; then turn the page and try again. The examples on the following pages show only a few of the many kinds of typographic structures that might evolve along the way.

In fact, the weaving of the text and the tailoring of the page are thoroughly interdependent. We can discuss them one by one, and we can separate each in turn into a series of simple, unintimidating questions. But the answers to these questions must all, in the end, fold back into a single answer. The page, the pamphlet or the book must be seen as a whole if it is to look like one. If it appears to be only a series of individual solutions to separate typographic problems, who will believe that its message coheres?

In analyzing the examples on the following pages, these symbols are used:

Proportions:
P = page proportion: h/w
T = textblock proportion: d/m

Page size:
w = width of page (trim-size)
h = height of page (trim-size)

Textblock:
m = measure (width of primary textblock)
d = depth (height) of primary textblock (excluding running heads, folios, etc)
λ = line height (type size plus added lead)
n = secondary measure (width of secondary column)
c = column width, where there are even multiple columns

Margins:
s = spine margin (back margin)
t = top margin (head margin)
e = fore-edge (front margin)
f = foot margin
g = internal gutter (on a multiple-column page)

Page and textblock proportions (P and T in the examples) are given here as single values (1.414, for example). To find the same values in the table on page 148, look up the corresponding *ratio* (1 : 1.414, for example).

octave	1 : 2	1 : 2	C – C′	*double square*	
major 7th	8 : 15	1 : 1.875	C – B		
minor 7th	9 : 16	1 : 1.778	C – B♭	*narrow*	
major 6th	3 : 5	1 : 1.667	C – A	*books*	
minor 6th	5 : 8	1 : 1.6	C – A♭		~ 1 : φ
fifth	2 : 3	1 : 1.5	C – G		
dim. 5th / *aug. 4th*	1 : √2	1 : 1.414	C – G♭ / C – F♯	*self-replicating page*	
fourth	3 : 4	1 : 1.333	C – F		
major 3rd	4 : 5	1 : 1.25	C – E		~ φ : 2
minor 3rd	5 : 6	1 : 1.2	C – E♭	*wide*	
major 2nd	8 : 9	1 : 1.125	C – D	*books*	
minor 2nd	15 : 16	1 : 1.067	C – D♭		
unison	1 : 1	1 : 1	C – C	*square page*	

The value for the diminished 5th/augmented 4th is calculated here according to the system of equal temperament. All other intervals are calculated according to the system of just intonation.

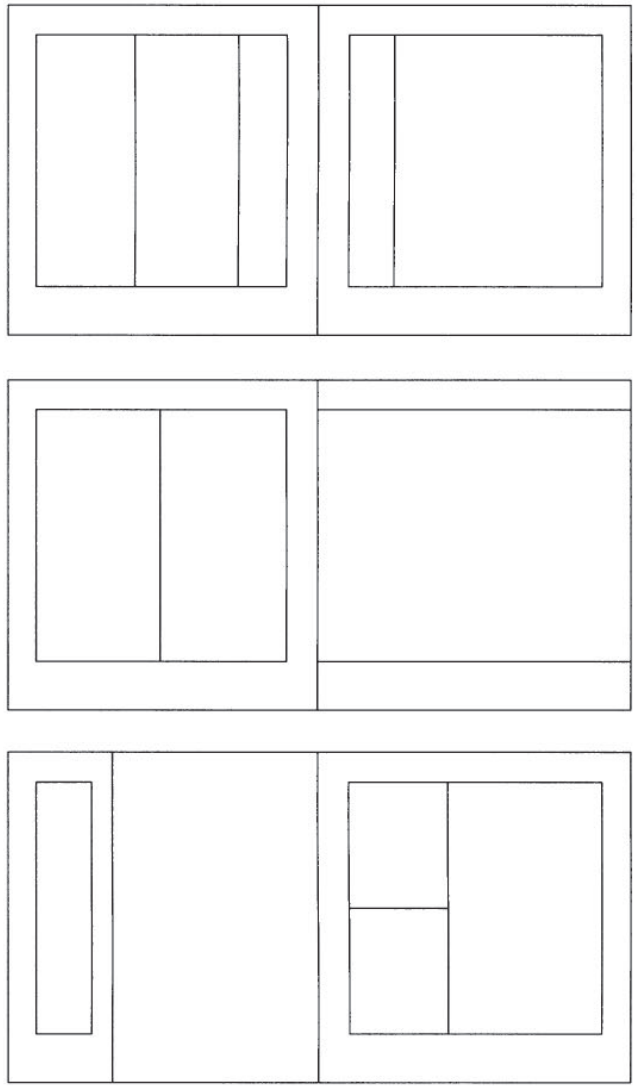
Page shapes derived from the chromatic scale. Two-page spreads that embody these proportions are shown on the facing page.

The perfect intervals (fifth and fourth) coincide exactly with the favorite page shapes of the European Middle Ages, which are still in use today: the page proportions 2 : 3 and 3 : 4. Renaissance typographers made extensive use of narrower pages, corresponding to the larger impure intervals (major and minor sixth, major and minor seventh).

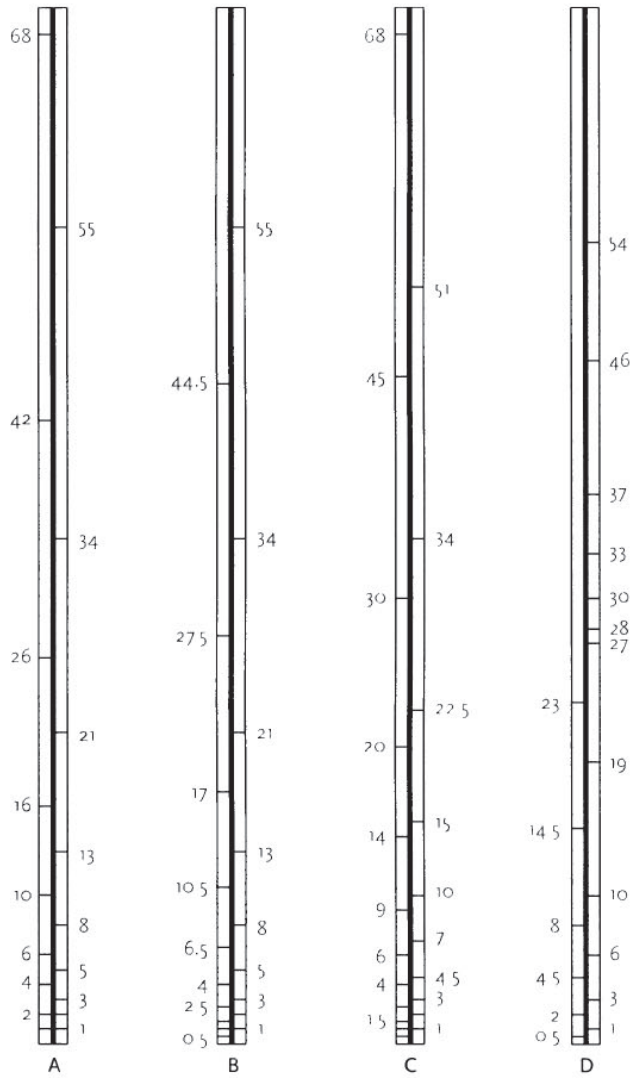
Each page shape has a counterpart with which it alternates. If a sheet whose proportions are 5 : 8 is folded in half, it produces a sheet whose proportions are 4 : 5. If this is folded once again, it produces another sheet whose proportions are 5 : 8. In the same way, the proportion 1 : 2 alternates with the proportion 1 : 1. The proportion 1 : $\sqrt{2}$, corresponding to the diminished fifth and augmented fourth of equal temperament, is the only one that alternates with itself.

In musical terms, these alternating proportions form harmonic inversions. (The harmonic inversion of a fifth, for example, is a fourth, and the harmonic inversion of a minor sixth is a major third.) The total of each such pair of intervals is always one octave.

		Page & Textblock Proportions		Sample sizes in inches		
octave	A	Double Square	1 : 2	4.5 × 9	5 × 10	5.5 × 11
	B	Tall Octagon	1 : 1.924	4.7 × 9	5.2 × 10	5.7 × 11
major 7th		8 : 15	1 : 1.875	4.8 × 9		
	C	Tall Hexagon	1 : 1.866			5.9 × 11
	D	Octagon	1 : 1.848	4.9 × 9	5.4 × 10	6 × 11
		5 : 9	1 : 1.8	5 × 9		
minor 7th		9 : 16	1 : 1.778		5.1 × 9	
	E	HEXAGON = 1 : $\sqrt{3}$	1 : 1.732	4.9 × 8.5	5.2 × 9	6.4 × 11
	F	Tall Pentagon	1 : 1.701	5 × 8.5	5.3 × 9	6.5 × 11
major 6th		3 : 5	1 : 1.667	5.1 × 8.5		
		Legal Sheet	1 : 1.647			8.5 × 14
	G	GOLDEN SECTION	1 : 1.618	5.3 × 8.5	5.6 × 9	6.8 × 11
minor 6th		5 : 8	1 : 1.6	5 × 8		
	H	PENTAGON	1 : 1.539	5.5 × 8.5	5.9 × 9	7.2 × 11
➤ *fifth*		2 : 3	1 : 1.5		6 × 9	7.3 × 11
	Z	ISO = 1 : $\sqrt{2}$	1 : 1.414	6.4 × 9	7.1 × 10	7.8 × 11
		5 : 7	1 : 1.4			
	J	Short Pentagon	1 : 1.376	6.5 × 9	7.3 × 10	8 × 11
➤ *fourth*		3 : 4	1 : 1.333	6.8 × 9	7.5 × 10	9 × 12
	K	Tall Half Octagon	1 : 1.307	6.9 × 9	7.7 × 10	8.4 × 11
		Letter Sheet	1 : 1.294			8.5 × 11
major 3rd		4 : 5	1 : 1.25	7.2 × 9	8 × 10	8.8 × 11
	L	Half Octagon	1 : 1.207		8.3 × 10	9.1 × 11
minor 3rd		5 : 6	1 : 1.2	7.5 × 9		
	M	Truncated Pentagon	1 : 1.176		8.5 × 10	9.4 × 11
		6 : 7	1 : 1.167	7.7 × 9		
		e : π	1 : 1.156			
	N	Turned Hexagon	1 : 1.155	7.8 × 9	8.7 × 10	9.5 × 11
major 2nd		8 : 9	1 : 1.125	8 × 9	8.9 × 10	9.8 × 11
	O	Tall Cross Octagon	1 : 1.082	8.3 × 9	9.2 × 10	10.2 × 11
minor 2nd		15 : 16	1 : 1.067	8.4 × 9	9.4 × 10	10.3 × 11
	P	Turned Pentagon	1 : 1.051	8.6 × 9	9.5 × 10	10.5 × 11
unison	Q	SQUARE	1 : 1	9 × 9	10 × 10	11 × 11
	R	Broad Pentagon	1 : 0.951	8.9 × 8.5	10 × 9.5	11 × 10.5
	S	Broad Cross Octagon	1 : 0.924	9.2 × 8.5	10 × 9.2	11 × 10.1
major 2nd		9 : 8	1 : 0.889	9.6 × 8.5		11 × 9.8
	T	Broad Hexagon	1 : 0.866	9.8 × 8.5	10 × 8.7	11 × 9.5
	U	Full Cross Octagon	1 : 0.829	10.3 × 8.5	10 × 8.3	11 × 9.1
major 3rd		5 : 4	1 : 0.8	10.6 × 8.5		11 × 8.8
		Landscape Letter	1 : 0.773	11 × 8.5	10 × 7.7	



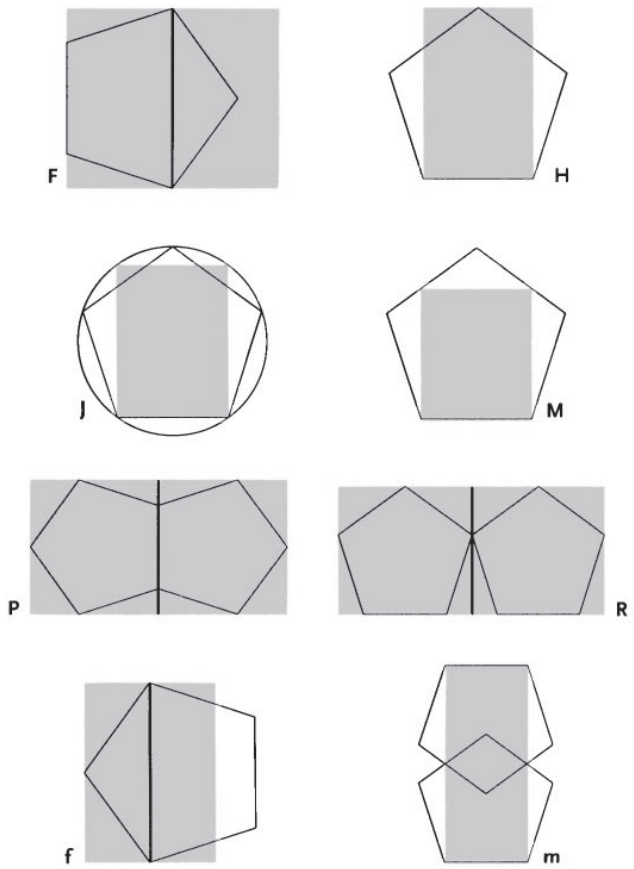
Use of the modular scale. These pages and textblocks have been subdivided using the Half Pica Modular scale. The pages are 52 × 55 picas (8⅝" × 9⅛"), with margins of 5, 5, 5 & 8 picas. The basic textblock is 42 picas square. Thousands of different subdivisions are possible. (For more complex examples on similar principles, see Le Corbusier, *The Modulor.*)



Four examples of modular pica sticks (shown at half actual size). **A** Whole Pica Modular scale. **B** Half Pica Modular scale. These are both two-stranded Fibonacci series, based on the ratios 1 : φ and 1 : 2. **C** Medieval Interval scale, based on the proportions 2 : 3 and 1 : 2. **D** Timaean Scale, a simplified version of the Pythagorean scale outlined in Plato's *Timaeus*.

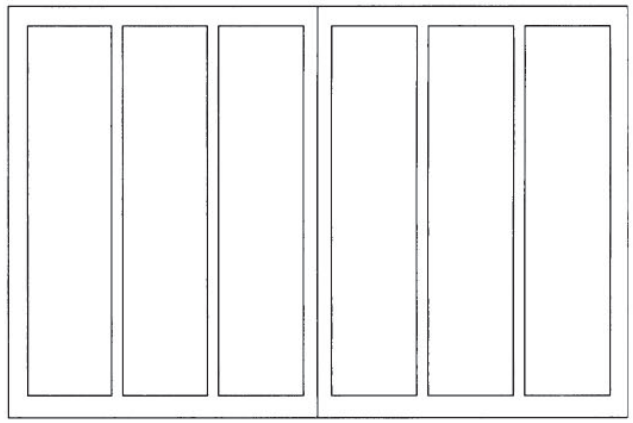
	Column Proportions		Sample sizes in picas			
a	Quadruple Square	1 : 4	10 × 40	11 × 44	12 × 48	*double octave*
	$1 : \sqrt{15}$	1 : 3.873	10 × 39			
	4 : 15	1 : 3.75		12 × 45		*major 14th*
	5 : 18	1 : 3.6	10 × 36	12 × 43		
	9 : 32	1 : 3.556	11 × 39			*minor 14th*
	$1 : \sqrt{12}$	1 : 3.464	11 × 38		15 × 52	
b	Octagon Wing	1 : 3.414		12 × 41		
	3 : 10	1 : 3.333		12 × 40	15 × 50	*major 13th*
	1 : 2φ	1 : 3.236				
	5 : 16	1 : 3.2			15 × 48	*minor 13th*
	$1 : \sqrt{10}$	1 : 3.162	12 × 38			
	1 : π	1 : 3.142		14 × 44		
c	Double Pentagon	1 : 3.078	12 × 37	14 × 43	16 × 49	
d	Triple Square	1 : 3	12 × 36	14 × 42	16 × 48	*twelfth*
e	Wide Octagon Wing	1 : 2.993				
z	$1 : 2\sqrt{2} = 1 : \sqrt{8}$	1 : 2.828				
f	Pentagon Wing	1 : 2.753		16 × 44		
	1 : *e*	1 : 2.718	14 × 38		18 × 49	
	3 : 8	1 : 2.667		15 × 40	18 × 48	*eleventh*
	$1 : \sqrt{7}$	1 : 2.646				
g	Extended Section	1 : 2.618				
h	Tall Octagon Column	1 : 2.613			18 × 47	
i	Mid Octagon Column	1 : 2.514				
	2 : 5	1 : 2.5	16 × 40	18 × 45	20 × 50	*major 10th*
j	Short Octagon Column	1 : 2.414				
	5 : 12	1 : 2.4			20 × 48	*minor 10th*
k	Hexagon Wing	1 : 2.309	16 × 37	20 × 46		
m	Double Truncated Pentagon	1 : 2.252				
	4 : 9	1 : 2.25		20 × 45		*major 9th*
	$1 : \sqrt{5}$	1 : 2.236	17 × 38		21 × 47	
	5 : 11	1 : 2.2		20 × 44	24 × 53	
	15 : 32	1 : 2.133			24 × 52	*minor 9th*
A	Double Square	1 : 2	18 × 36	21 × 42	24 × 48	*octave*

[The intervals listed in the right hand column on this page are *compound intervals* of the chromatic scale. Octave + minor 2nd = minor 9th; octave + major 3rd = major 10th; octave + fifth = twelfth, etc.]



F, P, R and f are shown here as two-page spreads. H, J, M and m are shown as single pages.

Pages derived from the pentagon: **F** the Tall Pentagon page, 1 : 1.701; **H** Pentagon page, 1 : 1.539; **J** Short Pentagon page, 1 : 1.376; **M** the Truncated Pentagon page, 1 : 1.176; **P** Turned Pentagon page, 1 : 1.051; **R** the Broad Pentagon page, 1 : 0.951; **f** Pentagon Wing, 1 : 2.753; **m** the Double Truncated Pentagon, 1 : 2.252. The pentagon page differs by 2% from the North American standard small trade book size, which is half the size of a letter sheet: 5½ × 8½ inches. A more eminent page proportion, the *golden section*, is also present in the pentagon (see page 156). In nature, pentagonal symmetry is rare in inanimate forms. Packed soap bubbles seem to strive for it but never quite succeed, and there are no mineral crystals with true pentagonal structures. But pentagonal geometry is basic to many living things, from roses and forget-me-nots to sea urchins and starfish.



Standard grid for three-column magazine

such) and are *not of uniform size*. The traditional sequence of type sizes shown on page 45, for example, is a modular scale. The single- and double-stranded Fibonacci series discussed on pp 157–158 are modular scales as well. These scales can, in fact, be put directly to use in page design by altering the units from points to picas. More examples of modular scales are shown on the following page.

It is perfectly feasible to create a new modular scale for any project requiring one, and the scale can be founded on any convenient single or multiple proportion – a given page size, for example, or the dimensions of a set of illustrations, or something implicit in the subject matter. A work on astronomy might use a modular scale based on star charts or Bode's law of interplanetary distances. A book on Greek art might be laid out using intervals from one or more of the Greek musical scales or, of course, the golden section. A work of modernist literature might be designed using something more deliberately arcane – perhaps a scale based on the proportions of the author's hand. Generally speaking, a scale based on two ratios (1 : φ and 1 : 2, for example) will give more flexible and interesting results than a scale founded on just one.

The Half Pica Modular scale illustrated overleaf is actually a miniaturized version of the architectural scale of Le Corbusier, which is based in turn on the proportions of the human body.

See Le Corbusier, *The Modulor* (2nd ed., 1954).

corner are the easiest to find by flipping pages in a small book. In large books and magazines, the bottom outside corner is generally more convenient for joint assaults by eye and thumb. Folios placed on the inner margin are rarely worth considering. They are invisible when needed and all too visible otherwise.

Margins and Satellites

It is usual to set folios in the text size and to position them near the textblock. Unless they are very black, brightly colored or large, the folios usually drown when they get very far away from the text. Strengthened enough to survive on their own, they are likely to prove a distraction.

8.5.4 *Don't restate the obvious.*

In Bibles and other large works, running heads have been standard equipment for two thousand years. Photocopying machines, which can easily separate a chapter or a page from the rest of a book or journal, have also given running heads (and running feet, or footers) new importance.

Except as insurance against photocopying pirates, running heads are nevertheless pointless in many books and documents with a strong authorial voice or a unified subject. They remain essential in most anthologies and works of reference, large or small.

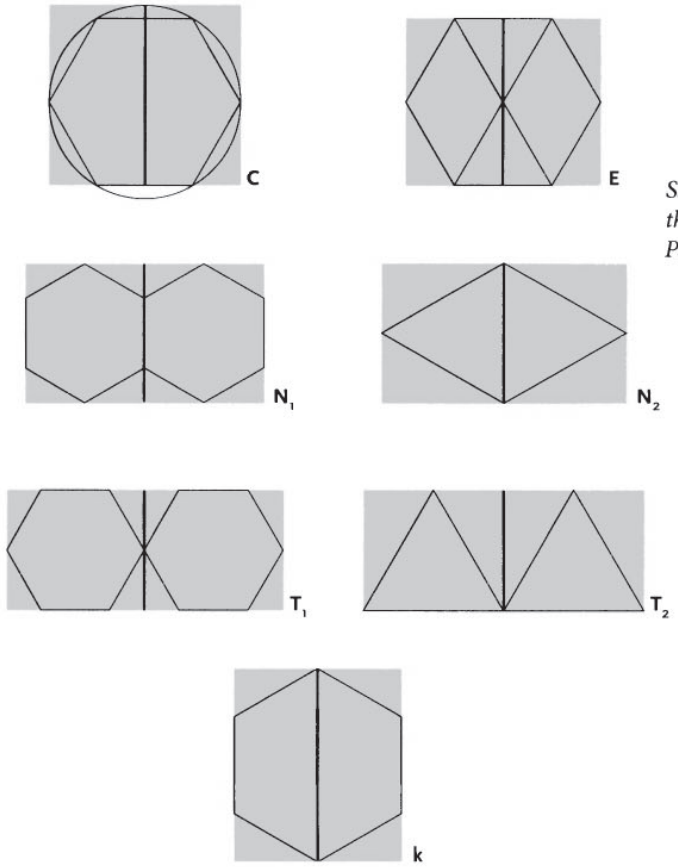
Like folios, running heads pose an interesting typographic problem. They are useless if the reader has to hunt for them, so they must somehow be distinguished from the text, yet they have no independent value and must not become a distraction. It has been a common typographic practice since 1501 to set them in spaced small caps of the text size, or if the budget permits, to print them in the text face in a second color.

8.6 PAGE GRIDS & MODULAR SCALES

8.6.1 *Use a modular scale if you need one to subdivide the page.*

Grids are often used in magazine design and in other situations where unpredictable graphic elements must be combined in a rapid and orderly way.

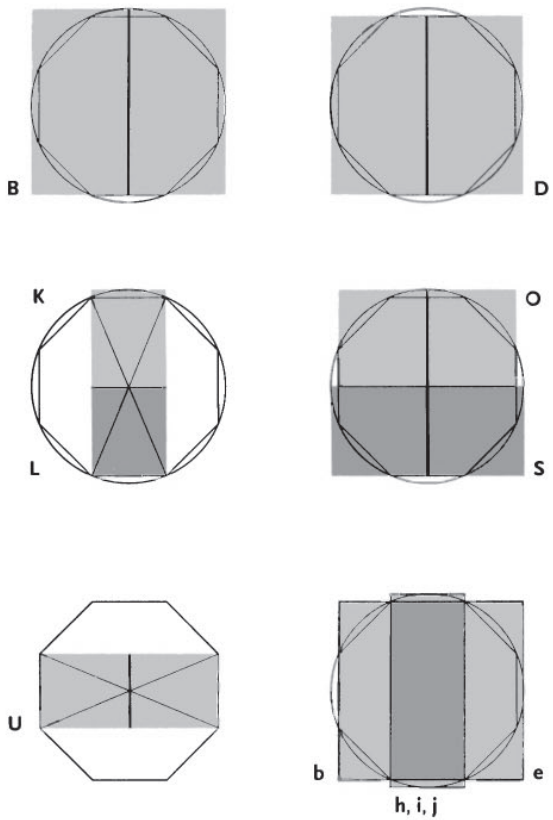
Modular scales serve much the same purpose as grids, but they are more flexible. A modular scale, like a musical scale, is a prearranged set of harmonious proportions. In essence, it is a measuring stick whose units are *indivisible* (or are treated as



Shaping the Page

Pages derived from the hexagon: **C** the Tall Hexagon page, 1 : 1.866; **E** Hexagon page, $1 : \sqrt{3} = 1 : 1.732$; **N** Turned Hexagon page, 1 : 1.155; **T** Broad Hexagon page, 1 : 0.866; **k** Hexagon Wing, 1 : 2.309. The hexagon consists of six equilateral triangles, and each of these page shapes can be derived directly from the triangle instead. The hexagon merely clarifies their existence as mirror images, like the pages of a book. Hexagonal structures are present in both the organic and the inorganic world – in lilies and wasps' nests, for example, and in snowflakes, silica crystals and sunbaked mudflats. The proportions of the broad hexagon page are within one tenth of one per cent of the natural ratio π/e, while the turned hexagon page (which is the broad hexagon rotated 90°) approximates the ratio e/π. (The hexagon page used in this book is analyzed on page 6.)

All formats on this page are shown as two-page spreads.



B, D, O, S and U are shown as two-page spreads.

Pages derived from the octagon: **B** the Tall Octagon page, 1 : 1.924; **D** Octagon page, 1 : 1.848; **K** Tall Half Octagon page, 1 : 1.307; **L** Half Octagon page, 1 : 1.207; **O** Tall Cross Octagon, 1 : 1.082; **S** Broad Cross Octagon page, 1 : 0.924; **U** the Full Cross Octagon page, 1 : 0.829; **b** Octagon Wing, 1 : 3.414; **e** Wide Octagon Wing, 1 : 2.993; **h, i, j** Tall, Middle and Short Octagon Columns, 1 : 2.613, 1 : 2.514 and 1 : 2.414. The tall half octagon page (**K**), used in Roman times, differs by a margin of 1% from the standard North American letter size. Are proportions derived from the hexagon and pentagon livelier and more pleasing than those derived from the octagon? Forms based on the hexagon and pentagon are, at any rate, far more frequent than octagonal forms in the structure of flowering plants and elsewhere in the living world.

8.5 MARGINS & SATELLITES

8.5.1 *Bring the margins into the design.*

In typography, margins must do three things. They must *lock the textblock to the page* and *lock the facing pages to each other* through the force of their proportions. Second, they must *frame the textblock* in a manner that suits its design. Third, they must *protect the textblock*, leaving it easy for the reader to see and convenient to handle. (That is, they must leave room for the reader's thumbs.) The third of these is easy, and the second is not difficult. The first is like choosing type: it is an endless opportunity for typographic play and a serious test of skill.

Perhaps fifty per cent of the character and integrity of a printed page lies in its letterforms. Much of the other fifty per cent resides in its margins.

8.5.2 *Bring the design into the margins.*

The boundaries of the textblock are rarely absolute. They are nibbled and punctured by paragraph indents, blank lines between sections, gutters between columns, and the sinkage of chapter openings. They are overrun by hanging numbers, outdented paragraphs or heads, marginal bullets, folios (page numbers) and often running heads, marginal notes and other typographic satellites. These features – whether recurrent, like folios, or unpredictable, like marginal notes and numbers – should be designed to give vitality to the page and further bind the page and the textblock.

8.5.3 *Mark the reader's way.*

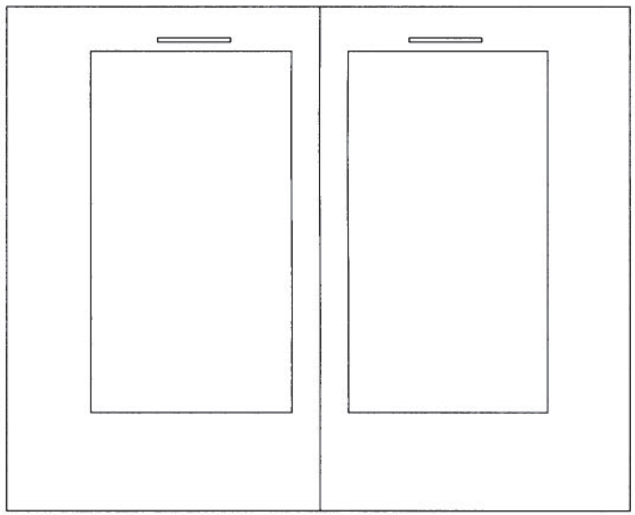
Folios are useful in most documents longer than two pages. They can be anywhere on the page that is graphically pleasing and easy to find, but in practice this reduces to few possibilities: (**1**) at the head of the page, aligned with the outside edge of the textblock (a common place for folios accompanied by running heads); (**2**) at the foot of the page, aligned with or slightly indented from the outside edge of the text; (**3**) in the upper quarter of the outside margin, beyond the outside edge of the text; (**4**) at the foot of the page, horizontally centered beneath the textblock.

The fourth of these choices offers Neoclassical poise but is not the best for quick navigation. Folios near the upper or lower outside

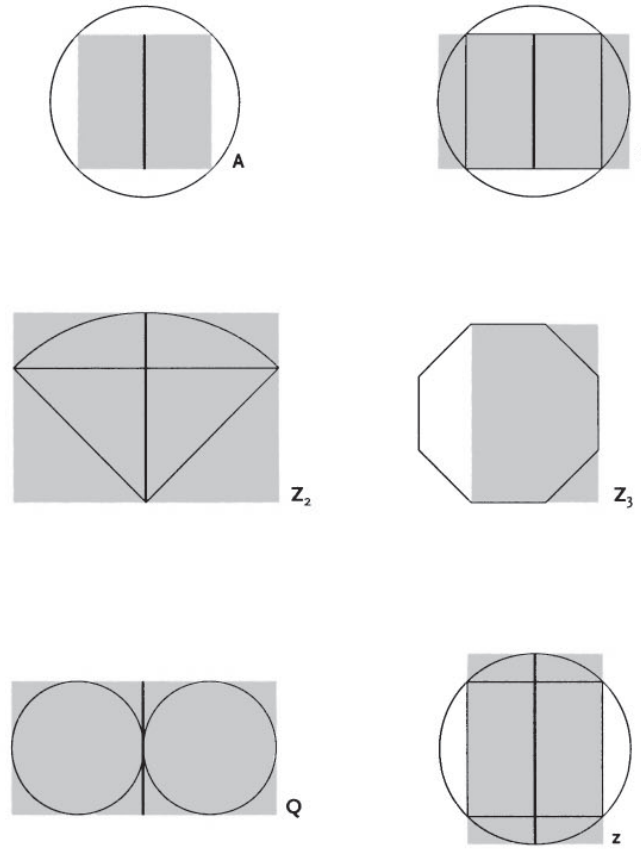
page. It is supplemented by secondary harmonies created by the proportions of the margins and the placement of the textblock – not in the center of the page but high and toward the spine.

The textblock itself, in this example, is symmetrical, but it is placed asymmetrically on the page. The lefthand page is a mirror image of the right, but no mirror image runs the other way. The two-page spread is symmetrical horizontally – the direction in which the pages turn, either backward or forward, as the reader consults the book – but it is asymmetrical vertically – the direction in which the page stays put while the reader's eye repeatedly works its way in one direction: down.

This interlocking relationship of symmetry and asymmetry, and of balanced and contrasted shape and size, was not new when this example was designed (in Venice in 1501). The first European typographers inherited some two thousand years' worth of research into these principles from their predecessors, the scribes. Yet the principles are flexible enough that countless new typographic pages and page-spreads wait to be designed.



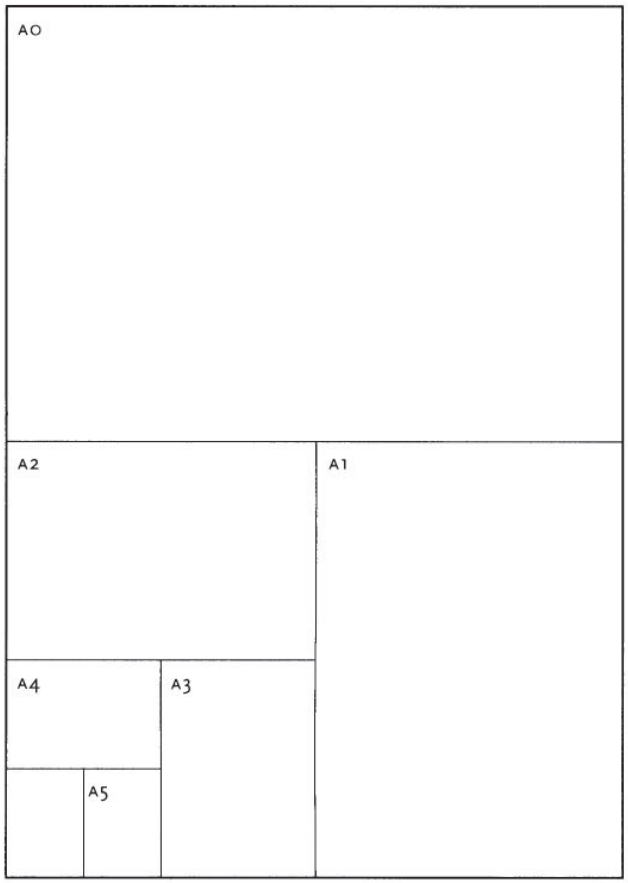
Page spread, probably by Francesco Griffo, Venice, 1501. The text is Virgil's *Aeneid,* set entirely in a crisp, simple italic lower case, 12/12 × 16, with roman small capitals, approximately 5 pt high. The original page size is 10.7 × 17.3 cm.



Except for Z_3, all formats on this page are shown as two-page spreads.

Pages derived from the circle and square: **A** Double Square page, 1 : 2; **Z** the Broad Square page, which is the ISO standard, $1 : \sqrt{2} = 1 : 1.414$; **Q** the Perfect Square; **z** Double ISO, $1 : 2\sqrt{2} = 1 : 2.828$. The proportion $1 : \sqrt{2}$ is that of side to diagonal in a square. A rectangle of these proportions (and no others) can be halved or doubled indefinitely to produce new rectangles of the same proportion. The proportion was chosen for that reason as the basis for ISO (International Organization for Standardization) paper sizes. The A4 sheet, for example, is standard European letter size, 210 × 297 mm = 8¼″ × 11⅝″. An 8½″ × 12″ book page also embodies this proportion.

The ISO or broad square page is latent not only in the square but in the octagon.



ISO sheet sizes:

A0 =841 × 1189 mm	A3 = 297 × 420 mm
A1 = 594 × 841 mm	A4 = 210 × 297 mm
A2 = 420 × 594 mm	A5 = 148 × 210 mm

When a sheet whose proportions are $1 : \sqrt{2}$ is folded in half, the result is a sheet half as large but with *the same proportions.* Standard paper sizes based on this principle have been in use in Germany since the early 1920s. The basis of the system is the A0 sheet, which has an area of 1 m^2. Yet precisely because it is *reciprocal with nothing but itself,* the ISO page is, in isolation, the least musical of all the major page shapes. It needs a textblock of another shape for contrast.

8.4.1 *If the text is meant to invite continuous reading, set it in columns that are clearly taller than wide.*

Horizontal motion predominates in alphabetic writing, and for beginners, it predominates in reading. But vertical motion predominates in reading for those who have really acquired the skill. The tall column of type is a symbol of fluency, a sign that the typographer does not expect the reader to have to puzzle out the words.

The very long and very narrow columns of newspapers and magazines, however, have come to suggest disposable prose and quick, unthoughtful reading. A little more width not only gives the text more presence; it implies that it might be worth savoring, quoting and reading again.

8.4.2 *Shape the textblock so that it balances and contrasts with the shape of the overall page.*

The proportions that are useful for the shapes of pages are equally useful in shaping the textblock. This is not to say that the proportions of the textblock and the page should be the same. They often were the same in medieval books. In the Renaissance, many typographers preferred a more polyphonic page, in which the proportions of page and textblock differ. But it is pointless for them to differ unless, like intervals in music, they differ to a clear and purposeful degree.

For all the beauty of pure geometry, a perfectly square block of type on a perfectly square page with even margins all around is a form unlikely to encourage reading. Reading, like walking, involves navigation – and the square block of type on a square block of paper is short of basic landmarks and clues. To give the reader a sense of direction, and the page a sense of liveliness and poise, it is necessary to break this inexorable sameness and find a new balance of another kind. Some space must be narrow so that other space may be wide, and some space emptied so that other space may be filled.

In the simple format shown overleaf, a page whose proportions are 1 : 1.62 (the golden section) carries a textblock whose proportions are 1 : 1.8 [5 : 9]. This difference constitutes a primary visual chord which generates both energy and harmony in the

Proportions of the Empty Page

Early Hebrew scribes generally favored a narrower column, and early Greek scribes a column narrower still. But they, like the Egyptians, were making scrolls instead of bound books. It is difficult, therefore, to compare modern notions of the page directly with theirs. You can open a scroll as wide as you like, exposing one column, two columns, three. This flexible approach to the concept of the page survives to some extent in early codices (bound books). There are early books that are three times taller than wide, others that are close to square, and many shapes between.

In medieval Europe, most books, though certainly not all, settled down to proportions ranging from 1 : 1.5 to 1 : 1.25. Paper – once the mills were built in Europe – was commonly made in sheets whose proportions were 2 : 3 [1 : 1.5] or 3 : 4 [1 : 1.33]. These proportions, which correspond to the acoustically perfect musical intervals of fifth and fourth, also reproduce one another with each fold. If a sheet is 40 × 60 cm [2 : 3] to start with, it folds to 30 × 40 [3 : 4], which folds to 20 × 30, and so on. The 25 × 38 inch [roughly 2 : 3] and 20 × 26 inch [roughly 3 : 4] press sheets used in North America today are survivors of this medieval tradition.

The page proportion $1 : \sqrt{2}$, which is now the European standard, was also known to the medieval scribes. And the tall half octagon page, 1 : 1.3 (the shape enshrined now in North American letter paper) has a similar pedigree. The British Museum has a Roman wax-tablet book of precisely this proportion, dated to about AD 300.

Renaissance typographers continued to produce books in the proportions 1 : 1.5. They also developed an enthusiasm for narrower proportions. The proportions 1 : 1.87 (tall hexagon), 1 : 1.7 (tall pentagon), 1 : 1.67 [3 : 5], and of course 1 : 1.62, the golden section, were used by typographers in Venice before the end of the fifteenth century. The narrower page was preferred especially for works in the arts and sciences. Wider pages, better able to carry a double column, were preferred for legal and ecclesiastical texts. (Even now, a Bible, a volume of court reports or a manual on mortgages or wills is likely to be on a wider page than a book of poems or a novel.)

Renaissance page proportions (generally in the range of 1 : 1.4 to 1 : 2) survived through the Baroque, but Neoclassical books are often wider, returning to the heavier Roman proportion of 1 : 1.3.

Shaping the Page

The golden section is a symmetrical relation built from asymmetrical parts. Two numbers, shapes or elements embody the golden section when the smaller is to the larger as the larger is to the sum. That is, $a : b = b : (a + b)$. In the language of algebra, this ratio is $1 : \varphi = 1 : (1 + \sqrt{5})/2$, and in the language of trigonometry, it is $1 : (2 \sin 54°)$. Its approximate value in decimal terms is 1 : 1.61803.

The second term of this ratio, φ (the Greek letter *phi*), is a number with several unusual properties. If you *add* one to φ, you get its square (φ × φ). If you *subtract* one from φ, you get its reciprocal (1/φ). And if you multiply φ endlessly by itself, you get an infinite series embodying a single proportion. That proportion is 1 : φ. If we rewrite these facts in the typographic form mathematicians like to use, they look like this:

$$\varphi + 1 = \varphi^2$$

$$\varphi - 1 = 1/\varphi$$

$$\varphi^{-1} : 1 = 1 : \varphi = \varphi : \varphi^2 = \varphi^2 : \varphi^3 = \varphi^3 : \varphi^4 = \varphi^4 : \varphi^5 \ \ldots$$

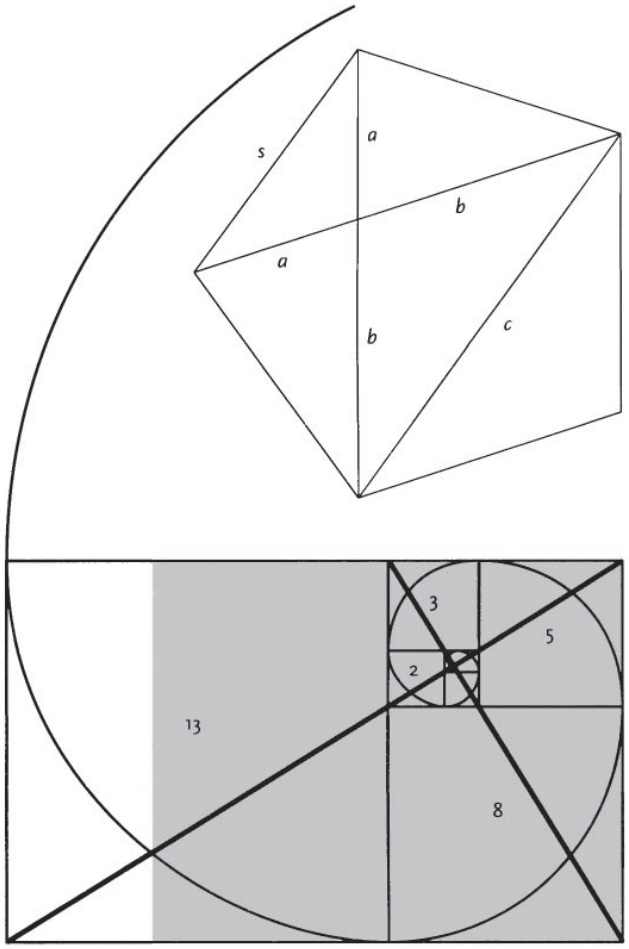
If we look for a numerical approximation to this ratio, 1 : φ, we will find it in something called the Fibonacci series, named for the thirteenth-century mathematician Leonardo Fibonacci. Though he died two centuries before Gutenberg, Fibonacci is important in the history of European typography as well as mathematics. He was born in Pisa but studied in North Africa. On his return, he introduced Arabic mathematics to North Italian scholars and also arabic numerals to the North Italian scribes.

As a mathematician, Fibonacci took an interest in many problems, including the problem of unchecked propagation. What happens, he asked, if everything breeds and nothing dies? The answer is a logarithmic spiral of increase. Expressed as a series of integers, such a spiral takes the following form:

0 · 1 · 1 · 2 · 3 · 5 · 8 · 13 · 21 · 34 · 55 · 89 · 144 · 233 · 377 · 610 · 987 · 1,597 · 2,584 · 4,181 · 6,765 · 10,946 · 17,711 · 28,657 …

Here each term after the first two is *the sum of the two preceding.* And the farther we proceed along this series, the closer

The Golden Section



The screened area represents a two-page spread in which each page embodies the golden section. The root of the spiral, which is the navel of the page, lies at the intersection of the diagonals. This is a Renaissance structure: precisely measured and formed, yet open-ended, unconfined. Like Thoreau's vision of the mind (page 66), it is *hypethral*. (Compare the equally elegant but closed, medieval structure on page 173 and the resolutely linear structure on page 154.)

G Golden Section, $1 : \varphi = 1 : 1.618....$ In the pentagon, the side s and the chord c embody the golden section. The smaller is to the larger as the larger is to the whole, or $s : c = c : (s + c)$. When two chords intersect, they divide each other in the same proportion: $a : b = b : c$, where $c = a + b$. Moreover, $b = s$. Thus, $a : s = s : c = c : (s + c) = 1 : \varphi$.

An evolving sequence of figures that embody the golden section also defines the path of a logarithmic spiral. And if the lengths of the sides of the figures are rounded off to the nearest whole numbers, the result is a Fibonacci series of integers.

8.3.2 *Choose page proportions suited to the content, size and ambitions of the publication.*

There is no one ideal proportion, but some are clearly more ponderous, others more brittle. In general, a book page, like a human being, should not peer down its nose, nor should it sag.

Shaping the Page

The narrower page shapes require a soft or open spine so that the opened book lies flat, and at smaller sizes, narrower pages are suitable only for text that can be set to a narrow measure. At larger sizes, the narrow page is more adaptable.

For ordinary books, consisting of simple text in a modest size, typographers and readers both gravitate to proportions ranging from the light, agile $5 : 9$ [$1 : 1.8$] to the heavier and more stolid $4 : 5$ [$1 : 1.25$]. Pages wider than $1 : \sqrt{2}$ are useful primarily in books that need the extra width for maps, tables, sidenotes or wide illustrations, and for books in which a multiple-column page is preferred.

When important illustrations are involved, these generally decide the shape of the page. Typically, one would choose a page somewhat deeper than the average illustration, both to leave extra blank space at the foot of the page, and to permit the insertion of captions. The e/π or turned hexagon page, $1 : 1.16$, for example, which is slightly deeper than a perfect square, is useful for square artwork, such as photographs taken with a square-format camera. The π/e or broad hexagon page, $1 : 0.87$, is useful for landscape photographs in the 4×5 format, and the full cross octagon page, $1 : 0.83$, for landscape photos in the wider format of 35 mm. (Uncropped 35 mm transparencies embody the proportion $2 : 3$.)

8.3.3 *Choose page and column proportions whose historical associations suit your intended design.*

Early Egyptian scribes (when not writing vertically) tended to write a long line and a wide column. This long Egyptian line reappears in other contexts over the centuries – on Roman imperial writing tablets, in medieval European charters and deeds, and in many poorly designed twentieth-century works of academic prose. It is a sign, generally speaking, that the emphasis is on the writing instead of the reading, and that writing is seen as an instrument of power, not an instrument of freedom. Whether oral or visual, longwindedness is very rarely a virtue.

The Golden Section

THIS PARAGRAPH, for example, is indented according to the golden section. The indent is to the remainder of the line as that remainder is to the full text measure. Here the measure is 21 picas, and the indent is 38.2% of that, which is to say 8 picas.

The amount of *sinkage* (the extra white space allowed at the top of the page) is 7 lines (here equal to 7 picas). Add the extra pica of white space created by the indent itself, and you have an imaginary 8-pica square of empty space in the upper left corner of the textblock.

The size of the elevated cap is related in turn to the size of the indent and the sinkage. Eight picas is 96 pt, and 61.8% of that is 59.3 pt. But the relationship between 59 or 60 pt type and an 8-pica indent would be difficult to perceive, because a 60 pt letter is not visibly 60 pt high. The initial used has an actual 60 pt cap height instead. Depending on the face, such a letter could be anywhere from 72 to 100 pt nominal size; here it is 84 pt Castellar.

8.3 PROPORTIONS OF THE EMPTY PAGE

8.3.1 *Choose inherently satisfying page proportions in preference to stock sizes or arbitrary shapes.*

The proportions of a page are like an interval in music. In a given context, some are consonant, others dissonant. Some are familiar; some are also inescapable, because of their presence in the structures of the natural as well as the man-made world. Some proportions also seem particularly linked to living things. It is true that wastage is often increased when an 8½ × 11 inch page is trimmed to 7¾ × 11 or 6¾ × 11, or when a 6 × 9 book page is narrowed to 5⅝ × 9. But an organic page looks and feels different from a mechanical page, and the shape of the page itself will provoke certain responses and expectations in the reader, independently of whatever text it contains.

we come to an accurate approximation of the number φ. Thus 5 : 8 = 1 : 1.6; 8 : 13 = 1 : 1.625; 13 : 21 = 1 : 1.615; 21 : 34 = 1 : 1.619, and so on.

In the world of pure mathematics, this spiral of increase, the Fibonacci series, proceeds without end. In the world of mortal living things, of course, the spiral soon breaks off. It is repeatedly interrupted by death and other practical considerations – but it is visible nevertheless in the short term. Abbreviated versions of the Fibonacci series, and the proportion 1 : φ, can be seen in the structure of pineapples, pinecones, sunflowers, sea urchins, snails, the chambered nautilus, and in the proportions of the human body as well.

Shaping the Page

If we convert the ratio 1 : φ or 1 : 1.61803 to percentages, the smaller part is roughly **38.2%** and the larger **61.8%** of the whole. But we will find the *exact* proportions of the golden section in several simple geometric figures. These include the pentagon, where they are relatively obvious, and the square, where they are somewhat more deeply concealed. Sunflowers, snails and humans who use the golden section *choose* it; they do not invent it.

The golden section, 1 : φ, differs by roughly one per cent from the interval of the minor sixth in the chromatic scale. The proportion 5 . 8, which is the arithmetic value of the minor sixth in music, is often used in typography as a rough approximation to the golden section.

The golden section was much admired by classical Greek geometers and architects, and by Renaissance mathematicians, architects and scribes, who often used it in their work. It has also been much admired by artists and craftsmen, including typographers, in the modern age. Paperback books in the Penguin Classics series have been manufactured for more than half a century to the standard size of 111 × 180 mm, which embodies the golden section. The Modulor system of the Swiss architect Le Corbusier is based on the golden section as well.

If type sizes are chosen according to the golden section, the result is again a Fibonacci series:

(a) 5 · 8 · 13 · 21 · 34 · 55 · 89 …

These sizes alone are adequate for many typographic tasks. But to create a more versatile scale of sizes, a second or third interlocking series can be added. The possibilities include:

(b) 6 · 10 · 16 · 26 · 42 · 68 · 110 …
(c) 4 · 7 · 11 · 18 · 29 · 47 · 76 …

All three of these series – **a**, **b** and **c** – obey the Fibonacci rule (each term is the sum of the two terms preceding). Series **b** is also

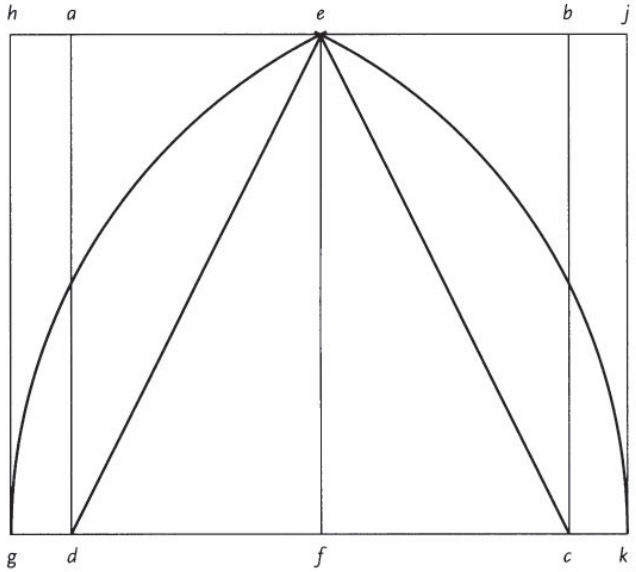
related to series a by simple doubling. The combination of a and **b** is therefore a two-stranded Fibonacci series with incremental symmetry, forming a very versatile scale of type sizes:

(**d**) 6 · 8 · 10 · 13 · 16 · 21 · 26 · 34 · 42 · 55 · 68 ...

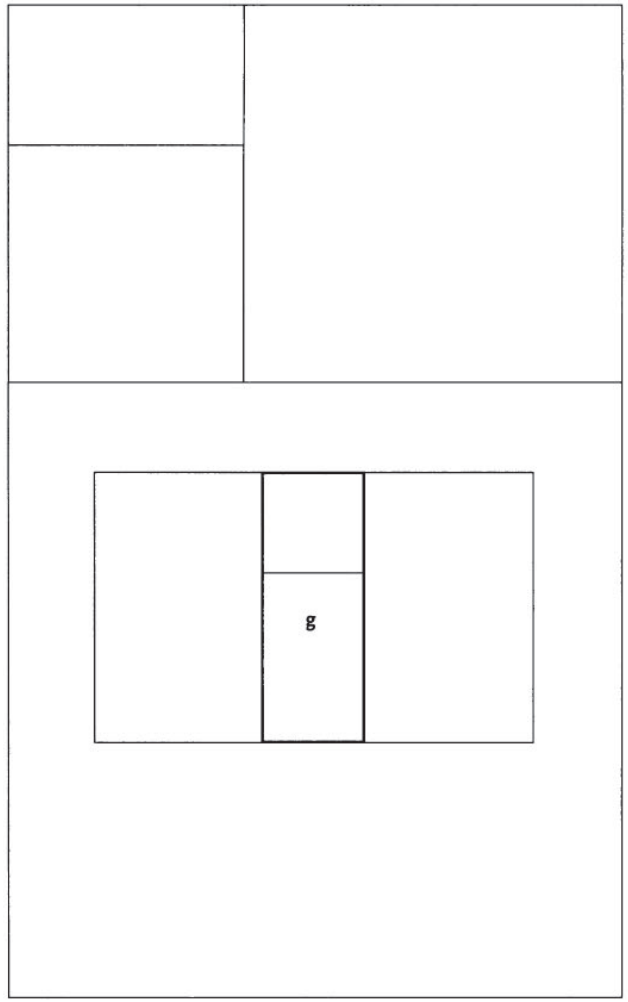
The Golden Section

The double-stranded Fibonacci series used by Le Corbusier (with other units of measurement) in his architectural work is similarly useful in typography:

(e)
4	6½	10½	17	27½	44½	72	...		
5	8	13	21	34	55	89			



Finding the golden section in the square. Begin with the square *abcd*. Bisect the square (with the line *ef*) and draw diagonals (*ec* and *ed*) in each half. An isosceles triangle, *cde*, consisting of two right triangles, is formed. Extend the base of the square (draw the line *gk*) and project each of the diagonals (the hypotenuse of each of the right triangles) onto the extended base. Now *ce* = *cg*, and *de* = *dk*. Draw the new rectangle, *efgh*. This and its mirror image, *ejkf*, each have the proportions of the golden section. That is to say, *eh* : *gh* = *gh* : (*gh* + *eh*) = *ej* : *jk* = *jk* : (*jk* + *ej*) = 1 : φ. (Contrast this with figure Z_2 on page 153.)



The relationship between the square and the golden section is perpetual. Each time a square is subtracted from a golden section, a new golden section remains. If two overlapping squares are formed within a golden-section rectangle, two smaller rectangles of golden-section proportions are created, along with a narrow column whose proportions are 1 : (φ + 1) = 1 : 2.618. This is **g**, the Extended Section, from the table on page 149. If a square is subtracted from this, the golden section is restored.